MARINE AND LAND HERMIT CRABS.

BY A. W. ROBERTS.

The marine hermit crabs, which the naturalists define as decapods (ten legged) crustacea of the genus *Eupagurus*, ought not be treated with contempt. Their high-sounding name should entitle them to some respect. Their history when told will afford material for observation and reflection.

We will begin with the little hermit crab, Figs. 1 and 2 (*Eupagurus longocarpus*), or long armed hermit crab, common on all parts of our coast, which is considered to be one of the most amusing and intelligent inhabitants that can be kept in the marine aquarium. It is very hardy and will live on either animal or vegetable substances, and is at the same time an excellent scavenger. The favorite dwelling of this crab is an empty shell of the little whelk (*Buccinum undatum*), one of the commonest shells on our coast. When placed in an aquarium these crabs dispiay great activity, and are always on the go, climbing up the rocks and algæ, or scuttling along the bottom with surprising agility.

All the marine hermits have the credit or discredit of being an exceedingly irritable and crabbed family of crustaceans, for whenever two hermits meet they are sure to engage in what appears to be a fierce encounter, until the weaker one abandons the contest and skedaddles in most ludicrous haste, often rolling over and over across the tank. Yet in all these encounters I have witnessed I have never seen as much as a claw lost, and am of the opinion that it is their way of having a good time.

It does not inconvenience a hermit crab in the least to lose or have a claw fractured; all he does or cares is to amputate it down to the next joint, at the same time making a hearty meal of the fragments of flesh that are removed during the operation. In a few weeks a new claw is developed, and he is as well off as ever. All crustaceans have this power of renewing lost members.

The claws, head, and shoulders of the hermit crab are encased in armor as hard as that of the lobster, but the hinder part of the body is soft and defenseless, hence the necessity of protecting it from the attacks of other fish by inserting the caudal extremities into the interior of the empty shells of some sea snail, winkle, or other univalve. By means of the appendages, or hook-like processes at the end of the tail (Fig. 2), the hermit crab is enabled to clasp the upper inside portion of the columella of a shell with wonderful tenacity, and rather than let go his hold will suffer decapitation. Another interesting fact in their organization is that the two sides of the body are unequal in size, thus enabling them to fit compactly in the chamber of the shell, their two larger claws are also unequal, and in some varieties flat on the inner sides, so that when the crab withdraws into his shell they fit closely together, securely closing the entrance against attack from outsiders.

As the hermit increases in size he is reminded by the uncomfortable tightness of his quarters that it is well to be on the look out for a more roomy home. This house hunting and removal is the most trying period in the life of a hermit, and brings out all his wonderful instinct. After carefully examining the empty shells that are in the aquarium he at last selects one for his new home. This he seems to lift up in his claws as if to try its weight, or to be certain there are no holes in it whereby the insidious neris worm might perform a rear movement on him unawares. Being satisfied as to lightness and exterior fitness, he proceeds with great gravity to examine the interior by inserting one of his long claws, very cautiously at first, as if to ascertain if anybody is inside; now twirls the shell round to make sure that it will prove a good fit, and that the walls of the chamber are smooth and free from sand, for the reception of his caudal extremity. Just at this critical moment a big hulking hermit comes along and butts him over, new house and all. For half an hour our house-hunting friend remains motionless inside his shell, with his front door claws closed tight, wondering what it was that went off. Presently out peep his long stalked eyes through a crevice of his claws, just to find out where he is; then he cautiously protrudes his legs and moves off in search of another shell. Coming across the previous one that had so pleased him, he gives it a wide berth, as a dwelling to be avoided by all wise house hunters. Having selected another shell, now comes the greatest trial of all in the life of a hermit crab, which is to get out of the old home and into the new without parting with his soft extremities. For who can tell but that some fish, who has been waiting and watching for many a day for just such a dainty meal of soft crab, is not at this very moment lying in wait for him to catch him just at the moment when he has left the old shell. To defeat such an attempt our little marine friend proceeds to place the entrance of the two shells near together; with most ludicrous haste he whisks out of his old house and backs into his new. For a minute he remains motionless, as if asking the question, "Am I all here?"

Should you wish to have a hermit leave his shell and take up his abode in one of your own selecting, the safest way to accomplish it is to place him on the disk of some large anemone. As soon as the hermit finds himself being engulfed in the thousand tentacles of the anemone he instantly realizes that his only chance for escape is to slide out of his shell and drop down. Another method is to place him in impure water, or water that is deficient in oxygen; but as soon as he leaves his shell he must be placed in good water and supplied with his new shell. The hermit crab is the first creature in an aquarium to show signs of distress when the lower strata of water becomes charged with deleterious gases He will abandon his shell and wander about without it, a most forlorn looking object.

During the months of July and August I have collected large quantities of hermit crabs at Gravesend Bay, Long Island, in the following manner: When the tide has fallen off the sand flats that skirt the Coney Island shore of the bay, I dig a semicircular trench, one foot deep, two feet wide,

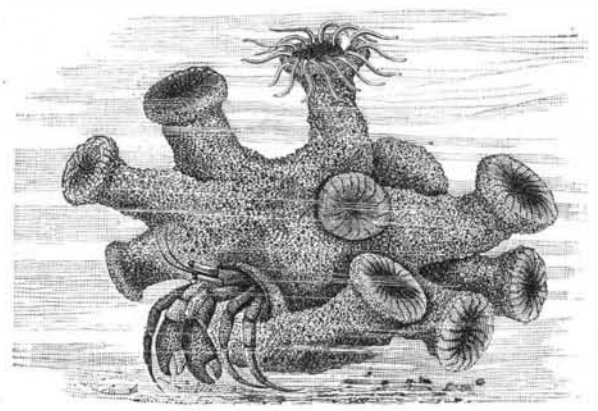


Fig. 3.—CORAL HERMIT CRAB.

and about twelve feet long. This trench is situated half way between high and low water. When the tide floods, up come the little hermits with it, to once more be in safety on the flats away from the dogfish and skate, which have a great weakness for these fat little hermits, swallowing them shells and all. When the advancing hundreds of little hermits reach the trench, into it they tumble, nor can they climb up the steep sides of shifting sand.

The next most common hermit crab is the short armed hermit crab (*Eupagurus pollicaris*). This species attains a large size, and inhabits the largest mollusks on our coast, viz., the pyrulas and naticas. I can only recommend this crab for use in public aquaria, it being so strong and active that when placed in a self-supporting aquarium, it soon

Fig. 1.—Little Hermit in Shell.

Fig. 2.—Little Hermit Out of Shell.

breaks up all artistic groupings of rock work and algæ. On different parts of our coast this crab is called by the fishermen "Jack in the Box," "Thief," and "Stone Lobster," and is believed by some fishermen to leave its shell and turn into a lobster. When collecting this crab many specimens will be taken deficient of one eye and even both; this is the work of the black fish and bergalls, which are partial to a diet of crabs' eyes. This fact was clearly proven at the New York Aquarium. When feeding the fish in the "shark tank," small particles of food were left on the floor of the tank, thereby endangering the health of the water. To overcome this difficulty I placed in the tank a large number of short

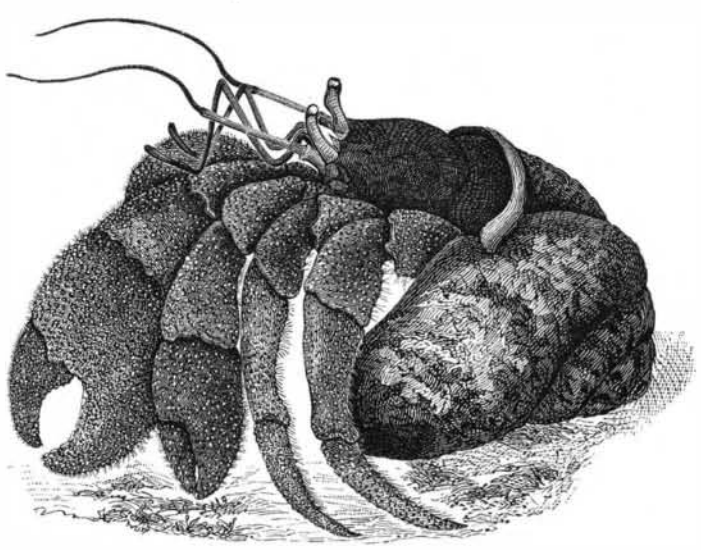


Fig. 4.—DIOGENES LAND HERMIT CRAB.

armed hermits and also blue crabs, to act as scavengers; no sooner were they in the water than the black fish began feasting on the eyes of these crabs. Most of the hermits managed to save their eyes by withdrawing into their shells during the day, and only venturing out at night to feed.

Fig 3 is *Eupagurus pubescens*, incrusted with *Epizoanthus Americanus*, one of our native corals. The specimen from which the enlarged drawing was made I dredged at Wood's Hole, Mass., and is about one inch in length by one-half inch in breadth. I generally dredged it in from thirty to forty feet of water.

I have obtained specimens of this crab with only a single polyp cell of the coral attached to their shells, clearly proving the fact that this incrustation of living coral at first starts with a single coral polyp. In course of time this coral growth so nearly closes up the entrance to the shell that the crab inside is unable to make his exit when he wishes to occupy a larger shell, which always occurs when the "shedding" period commences, and in consequence drags out a miserable existence, finally perishing in a tomb of living coral.

This doubly interesting crab lives well in a self-supporting aquarium, but requires to be fed by hand, as it is not much of a forager with the heavy load of coral. In the cut two of the coral polyps are shown fully expanded.

Fig. 4 illustrates one of our most beautiful of land hermit crabs (*Cenobita Diogenes*), native of Florida. For many months past a large number of these interesting and beautifully colored crabs have been on exhibition at the New York Aquarium, and have attracted much attention. This crab does not seem to prefer any particular shell, so long as it obtains a secure covering for its soft and unprotected parts; turbos and cones are all the same to it.

The first lot of these crabs that came under my charge I placed in a tank, from the inner side of which was suspended a chain used for the purpose of pulling out a plug from the bottom of the tank. When feeding them next morning I was surprised to find a number of them missing, nor did I for a long time suspect that they had climbed up the small chain and escaped from the tank. After this discovery I often suspended pieces of twine inside of the tank, up which they would climb at night and treat themselves to a walk around the floor.

These crabs are nocturnal in their habits, and during the day they withdraw into their shells, huddling in one corner of the tank. I fed them on apple, mashed potatoes, and oyster crackers.

Fire Engine for H. M. S. Sultan.

On the 13th January, the concluding trial of the steam pumping engine and steam fire engine constructed by Messrs. Shand, Mason & Co., for H. M. S. Sultan, took place on board that ship at Portsmouth Dockyard. The order for the pumping engine was given in consequence of the satisfactory results attending one designed by the same makers for H. M. S. Hercules, which has been in use in that ship since March, 1878. In addition to the pumping engine a powerful steam fire engine, also by Shand, Mason & Co., has been fixed on board the Sultan, both engines being connected with the same boiler. This latter is of the makers' well known "inclined water tube" type, so extensively used with their steam fire engines, the pumping and fire engine being on the plan of their equilibrium engine. The pumping engine consists of three steam cylinders, each 10 inches in diameter, placed vertically and connected direct to three bucket and plunger pumps, the buckets being 17¾ inches with a stroke of 13 inches. The construction of the steam fire engine is similar, but is placed horizontally, the three steam cylinders being 8½ inches in diameter, and the buckets of the plunger pumps 8¾ inches, with a stroke of 8 inches. The boiler and engines are placed sufficiently high in the ship so as to be worked even with a large quantity of water in the hold, special attention having been paid to the valves of the pumping engine, so as to draw water without fail from the lowest part of the ship. The preliminary trial took place on the 6th instant, when the following four jets were used at the same time: one 1⅛ inch. one 1 1-16 inch, and two each 1 inch, when a height, as measured by the mast, of 170 feet was reached. It was then found that the means for supplying the pumping engine with a sufficient quantity of water was inadequate, and this test was adjourned for the purpose of making arrangements to admit a sufficient quantity of water into the hold. On the 7th instant a test of the fire engine was made in the presence of Admiral Foley, Superintendent of Portsmouth Dockyard, when with one jet, 1½ inch in diameter, the water was thrown considerably above the top of the mast, a height of 200 feet. The following four jets were used simultaneously, one each 1½ inch, 1⅛ inch, 1 1-16 inch, and 1 inch, delivering 1,120 gallons per minute under a water pressure of 100 lb. on the square inch. The tests on the 13th instant and that on the 6th were conducted under the superintendence of Mr. Newman, Chief Engineer, Portsmouth Dockyard, Mr. Marcom, his assistant, Mr. Icely, Inspector of Machinery, Captain Wells, Superintendent of the Steam Reserve, Mr. Shearman, Chief Engineer of H. M. S. Sultan, and other gentlemen, all of whom were perfectly satisfied with the result, Mr. Shand being present on behalf of the contractors. The experiments occupied about two hours, the result of half an hour's continuous working with the pumping engine, with an average of 84·6 revolutions per minute, delivering 720 tons per hour from a depth of 21 feet 6 inches below the pump valves, and delivering under a pressure of from 20 lb. to 25 lb. on the square inch, this rate of delivery being practical, not theoretical, as the quantity was tested from the influx of water through valves from the side of the ship into a measured area of the hold.—*Engineering.*

MR GEORGE BERWICK has taken a series of photographs of the moon on very sensitive plates—the bromo-gelatine. One of the plates shows three well defined rings around the moon. Whether the rings are due to cosmical, atmospheric, chemical, or optical causes is not yet determined.

The Manufacture of Porpoise Oil.

BY CAPT. CALEB COOK, OF PROVINCETOWN, MASS.

About the year 1816, sailors and fishermen having caught a porpoise on their voyage, would sometimes extract the oil from the jaw bone and give it to carpenters and those who used oil stones for sharpening their tools. Finding in this way that it did not gum or glue, suggested the idea that it was just what was wanted for a nice lubricator. It was noticed that the weather at zero would not congeal it, neither would it corrode on brass.

Watchmakers were then using olive oil as the only fitting oil for watches; but by experimenting with the porpoise jaw oil they found it superior to the olive or any other oil, consequently the sailors and fishermen found a ready market for all they were able to obtain.

This state of things continued until the year 1829, when a shoal of blackfish, about forty in number, was taken at Provincetown, Mass., being the first for many years. Solomon Cook, of that town, took from the jaws of those blackfish a few gallons of oil, and sent it to Ezra Kelley, of New Bedford, Mass., a skillful watchmaker, to be tested for watch oil. Mr. Kelley soon found that this oil was superior to the porpoise oil, as it had more substance and less chill. He contracted with Solomon Cook to supply him from year to year until 1840, when Solomon Cook died, and his oldest son supplied Mr. Kelley until the demand was so great that the jaws of the blackfish were not sufficient to supply the market.

Porpoise jaw oil can be refined a little by exposure to the cold at zero, and in that state, with the atmosphere at zero, it is strained through a cotton flannel strainer made in the shape of a cone, but when filtered through paper it is so limpid that it has no lubricating properties whatever, and becomes useless. This oil is called porpoise jaw oil, but is taken from the blackfish, belonging in the family of whales, by a method known only by myself. It is warranted not to congeal with cold at zero, though it will thicken and turn a little milky in appearance. It is warranted not to corrode on brass or rust on steel, and it will not glue on the finest watch. Ezra Kelley, of New Bedford, Mass., has made it a business for many years to put it up for watch use, and has led in the market, while B. H. Tisdale, of Newport, R. I., and I. M. Bachelder, of Boston, are getting quite popular in the European market.

Caleb Cook, youngest son of Solomon, from scientific experiments, did discover, about the year 1842, that the melon oil of the blackfish was far superior to the jaw oil in every respect—so much so that Mr. Kelley, who had about this time become very popular in preparing this oil for the trade, would not buy it until he was told what it was produced from; and from that time to the present, 1876, Caleb Cook's blackfish melon (watch) oil has been refined by Kelley, of New Bedford, Bachelder, of Boston, Tisdale, of Newport, and many others on a smaller scale, for the world's use. Since the year 1842, Caleb Cook, of Provincetown, Mass., claims to be the only person who understands the art of producing this oil free from all glutinous matter and fit for use. This, he says, is done by a process known only by himself—not by mixing other oils or liquids with it, but by extracting all the acid and gluten from it, and leaving the oil pure for the finest and most delicate machinery. This, he says, cannot be done by the chilling and straining process; for when it becomes perfectly transparent at zero, the lubricating properties are all gone, the oil runs off the pivots, spreads on the plates, dries up, the pivots cut, turn red, and the oil is worse than worthless, for the valuable timekeeper is no longer what it was once for the want of oil with more substance and lubricating properties.

Porpoise jaw oil and blackfish melon oil are worth from $5 to $15 per gallon, according to supply. These oils are sold under the above trade names, and also under the names "watch oil" and "clock oil." They are used largely by manufacturers of firearms, watches, and philosophical apparatus. Smith & Wesson, of Springfield, Mass., the Ethan Allen factory, at Worcester, Bye & Johnson, of Worcester, the Howard Watch Company, the Elgin Watch Company, the Waltham Watch Company, and the clock factories in Connecticut, use them constantly. The philosophical instrument makers use them for air pumps, as they keep the leather always soft and pliable. Telegraph instrument makers use them when they can get them. They are used in government lighthouses for the clocks of revolving lights. The color of the oils is very light, and can be made very white by placing in the window, where they will bleach in a short time. One drop of water in one pint of the oil will injure it very much.

It may be interesting to know how those fish or whales are taken. They make their appearance about the shores of Cape Cod and Barnstable Bay from early in the summer until early in winter; and when it becomes known that a shoal of blackfish is in the bay, the boats are manned and proceed at once to get in their rear; and, as the fish are at the surface of the water the most of the time, it is easy to tell how to manage to keep them between the boats and the shore. While in this position the men in the boats will make all the noise with their oars they can, and that will cause them to go in the opposite direction from the boats and toward the shore; and when the fish find that they are in shoal water, by seeing the sandy bottom, they become alarmed, and go with all their might till they run fast aground on the sand. The boats then row in their midst; the men with lance in hand jump out of their boats into the water, and butcher them as a butcher would a hog, and it becomes one of the most exciting occasions that it is possible to imagine, for the water flies in every direction, and the blood flows freely until death puts an end to the great tragedy. When the water ebbs and leaves them dry, their blubber is taken off, cut in slices, and the oil tried out. About thirty gallons upon an average is what one fish will make, and the melons will average about six quarts. The melons are taken from the top of the head, reaching from the spout hole to the end of the nose, and from the top of the head down to the upper jaw. When taken off in one piece, they represent a half watermelon, weighing about twenty-five pounds. When the knife is put into the center of this melon, the oil runs more freely than the water does from a very nice watermelon—hence the name melon oil.

About the same time that the blackfish made their appearance in our waters, another of the whale species made its appearance also, called by the fishermen "cowfish" and by the historian "grampus." These whales are very much in the shape of the blackfish, only smaller, not so fat, and not so dark colored. The oil from the melon of this fish is thought to be superior to anything yet found in the blackfish or the porpoise. It is of a very yellow color, and when reduced by the chilling and straining process, it appears to have all the body and lubricating properties that are wanted for the very best watch oil; but as it will take one year to determine it by practical experiments, it is thought best to keep it out of the market for the present.

This fish has made its appearance in our waters but three or four times in the last forty years, or about once in ten years. The method of taking it is the same as for the blackfish.

Cape of Good Hope Whales.

The villages between Simon's Bay and Wynberg have fences made of various bones of whales. A whale fishery was formerly carried on here, but no longer pays. An extremely interesting and very rare whale is occasionally procured at the Cape. It isa ziphioid, *Mesoplodon layardii*. The ziphioids are a group of the toothed whales, and allied to the sperm whale. They have the bones of the face and upper jaw drawn out and compressed into a long beak-like snout, which is composed of solid bone, hard and compact like ivory.

The upper jaw is devoid of teeth, having lost them in the process of evolution, and the lower jaw, which is lengthened and pointed to correspond with the upper, retains but a single pair of teeth. In the species in question, these two teeth in the adult animal become lengthened by continuous growth of the fangs into long curved tusks. These arch over the upper jaw or beak, and crossing one another above it at their tips, form a ring around it and lock the lower jaw, so that the animal can only open its mouth for a very small distance indeed.

The tusks are seen always to be worn away in front by the grating of the confined upper jaw against them. How the animal manages to feed itself under these conditions is a mystery. It is remarkable that the main mass of each tusk is made up of what appears as an abnormal growth of the fang. The actual conical tooth, that is, the orginal small cap of dentine of the tooth of the young animal, which corresponds to the part of the tooth showing above the gum in other whales, does not increase at all in size, but is carried up by the growth of the fangs, and remains at the tips of the tusks as a sort of wart-like rudimentary excrescence.

Specimens of *Mesoplodon layardii* are excessively rare, and I sought diligently for such during the whole of my stay at the Cape, and was rewarded by procuring parts of two skulls.

One of these, a skull without the lower jaw, I found near Mr. McKellar's at Cape Point. The skull was exposed on the beach, being stuck up with its beak thrust into the sand to be used as a rifle target.

The animal, as Mr. McKellar told me, had come on shore about eight years before. It yielded oil of a very superior quality, which sold for more than twice the price of ordinary whale oil.

It was about 10 feet in length, and was, as far as he remembered, colored black on the back and white on the belly, with a conspicuous line of demarkation of the colors on the side. The beast had the usual tusks.

The other specimen consisted of the snout and lower jaw, with the tusks, of another example of the species. It was given me by Mr. A. M. Black, of Simon's Town. The animal came on shore at Walwick Bay in 1869. It yielded 80 gallons of oil, and was from 16 to 18 feet in length. It is remarkable that these whales seem never to be met with or caught at sea. They always are procured by their running on shore. The ziphioids are especially interesting, because many species were abundant in tertiary times, and their beaks being so dense in structure as to be readily preserved as fossils, are common in such deposits as the Red Crag of Suffolk. I had the good luck to procure another ziphioid at the Falkland Islands during the voyage, near Port Darwin.—*H. N. Moseley's Challenger Notes.*

In the Clutch of an Octopus.

Our readers are familiar with the appearance of the octopus from the illustrations of it which have appeared in these columns, and therefore they will understand the manner in which a diver in Australia was attacked by one of these monsters, as graphically described by the victim in the Melbourne *Argus:* "Having thrust my arm into a hole, I found that it was held by something; the action of the water was stirring up the clay, and therefore I could not see distinctly for a few minutes; but when it did clear away I saw to my horror the arm of a large octopus entwined around mine like a boa-constrictor. Just then he fixed some of his suckers on the back of my hand, and the pain was intense. I felt as if my hand was being pulled to pieces, and the more I tried to take it away the greater the pain became; and from past experience I knew this method would be useless. I had the greatest difficulty in keeping my feet down, as the air rushed along the interior of my dress and inflated it; and if my feet had got uppermost I should soon have become insensible; and if I had given the signal to be pulled up the brute would have held on, and the chances would have been that I should have had a broken arm. I had a hammer by me, but could not reach down to get it. There was a small iron bar about five feet from me, and with my foot I dragged this along until I could reach it with my left hand. And now the fight commenced; the more I struck him the tighter he squeezed, until my arm got quite benumbed. After a while I found the grip began to relax a little, but he held on until I had almost cut him to pieces, when he relaxed his hold from the rock and I pulled him up. I was completely exhausted, having been in that position for over twenty minutes. I brought the animal up, or rather a part of it. We laid him out, and he measured over eight feet across; and I am convinced that this fellow could have held down five or six men."

Women as Physicians.

In an article in the *International Review*, Dr. Chadwick makes the just observation that the question is no longer, Shall women be allowed to *practice* medicine? They are practicing it, not by ones and twos, but by hundreds; and the only problem now is, Shall we give them opportunities for studying medicine before they avail themselves of the already acquired right of practicing it? It is clearly the interest of the community to give to women the fullest instruction, in accordance with the most improved systems, and under the most eminent teachers; and also that their proficiency should be tested by the most rigid ordeals before they finally receive certificates. By a recognition of these certificates and their comparative values, the community would be able to protect itself from the impositions of ignorant or fraudulent pretenders to medical knowledge.

In this connection it will be interesting to notice the remarkable medical missionary work now going on in China, and the skill of an American young lady physician, Miss L. A. Howard, who has lately had the good fortune of restoring to health the wife of the great Governor-general Li-hung-chang, who entertained General Grant so handsomely. Rev. D. Z. Sheffield, of Tung-cho, North China, writes as follows to the *Missionary Herald:*

"Recent letters from missionaries in North China give intensely interesting accounts of the sudden providential inauguration of medical missionary work in Tientsin, on a grand scale, and under very remarkable auspices. The importance of this advance movement can hardly be overestimated, and it is not too much to be hoped that it will give a new impetus to every department of missionary effort."

Rev. A. H. Smith, of Tientsin, writes as follows: "Dr. Mackenzie, a medical missionary of the London Mission, was transferred to this city last spring, with a view to opening an extensive medical work here, which has never yet been done. A petition was presented to His Excellency the Governor-general of the province, Li-hung-chang, the most influential man in China, asking his co-operation. Owing, perhaps, to the arrival of General Grant and the ensuing excitement no reply was made. A few weeks since the wife of His Excellency, long an invalid, was so low that native physicians gave her up after administering all the most expensive drugs in the Chinese pharmacopœia, and, as they told the Governor-general, knew nothing else to do unless to begin and give them all over again! In this emergency two foreign physicians were summoned, who saved Madame Li's life. As Chinese prejudice forbids much that occidental civilization allows, it was necessary to a complete cure to summon a lady physician, which was done with the assent of His Excellency the Governor-general.

"Miss L. A. Howard, of the American Methodist Mission, arrived here early in August, and took up her quarters in a suite of three rooms near to Lady Li in the yamên, or official residence. Missionaries have occasionally been in the yamên of viceroys before, but it has generally been either in the capacity of beggars or as prisoners, never as physicians in charge. Miss Dr. Howard has lived in the yamên about three weeks, and Madame Li is so far recovered as to be considered well. The fame of foreign medicine has gone abroad with the highest indorsement. The foreign physicians operated in certain surgical cases in the yamên, and the patients made a successful recovery. As native doctors know nothing of surgery this is looked upon as a wonderful art. The Governor-general has not formally granted the petition referred to, but he has opened a dispensary in the largest temple in Tientsin, in that portion of it used as a memorial temple to his predecessor, the late Tsêng-kuo-fan. The medicines are furnished by the Governor general, and the missionary physician in charge has full liberty to preach the gospel to every patient. A few weeks ago such an event would have been considered utterly improbable. its consequences can hardly be foreseen. Li-hung-chang is the statesman who last year remarked, during the famine relief, that there must be something in a religion which induces men to lay down their lives for total strangers of a

different nation. Little by little the great wall of Chinese prejudice is falling in pieces. As it falls Christianity enters."

Rev. Isaac Pierson, of the Pao-ting-fu station, who spent some weeks at Tientsin, writes at a later date: "A commission was sent (by Li-hung-chang) to Dr. Mackenzie, appointing him, in company with Dr. Irwin, physician to the yamên—the latter practicing medicine for a calling, being made the recipient of a salary which will equal five hundred dollars a year. Dr. Mackenzie was appointed, or commissioned, 'to heal the sick,' of the city, and a large yard with ample buildings was forthwith set apart to his use. This is part of the great temple of the city recently built by the same Viceroy—the temple in which he received and did honor to General Grant. Miss Howard has been promised a similar commission to treat the women, and is to have another court and buildings at the temple for her dispensary. The Viceroy promises to pay all the expenses of this dispensary work.

"For nearly three weeks the dispensary has been opened, and Dr. Mackenzie, assisted by our vice consul, Mr. Pethick, who has been indefatigable in his labor of love, has daily given treatment to eighty or ninety patients, in addition to an average of forty or fifty opium takers, who with medical help are trying to break off the habit of using opium. Many interesting surgical operations are performed. Four days ago the number of hare lips cured had reached eleven. There is a general of the army at the dispensary whose leg is being reset for an old fracture. Many other surgical operations have been successfully performed. In all this the Viceroy is intensely interested."

This feature of surgical operations, performed with the approval of the Viceroy, strikes one acquainted with the former prejudice of the Chinese against the use of the knife on the human body, as the most remarkable thing in this whole movement. In past years foreign physicians have not dared to let it be known that they had such a thing as a human skeleton in their house, and a few years ago, when Dr. Dudgeon was lecturing to the students in the Peking University on the anatomy of the human body, he dissected a sheep in their presence, as the dissection of a human body would not for a moment have been allowed. Mr. Pierson further says: "It has been said by some that a medical work could not be carried on here, but here is one already started, upon a basis superior in many respects to any in China, and with the strong presumption of its being a permanent one."

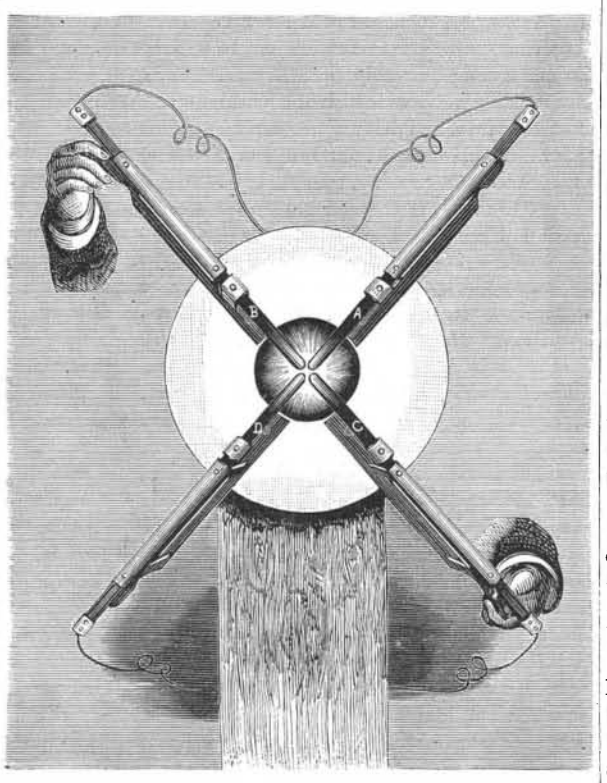
From these letters it will be seen how rare is the opportunity for medical missionary labor in North China. Preaching missionaries are already offering themselves to go and strengthen the hands of their brethren in that interesting field. No grander opportunity could be offered to the consecrated ambition of a Christian physician than that now offered. Urgent appeals are being made for physicians from the stations of Pao-ting-fu, Kalgan, and Tung-cho. Shall not the hearts of the brethren at the front be soon cheered with the glad intelligence that men are on the way to enter upon the work of ministering to men's bodies, and thus assist in the great work of ministering the bread of life to the famishing myriads of the heathen?

THE STEAM VELOCIPEDE.

At the recent Industrial Exhibition at the Champs Elysées, Paris, M. Perreaux, of Orne, exhibited a steam velocipede, which is illustrated herewith. The generator, the fireplace, and the motor are arranged behind the saddle of the velocipede, after the manner of the portmanteau of a horseman. Chains or belts transmit motion from the engine to the wheels. All the parts are small, well put together, and very compact. The small tubular boiler is cylindrical and has a capacity of about three quarts; and at the sides there are two receptacles containing a sufficient supply of water to last during a journey of two to three hours. The piston of the engine is about one inch in diameter and has a three inch stroke. The whole engine is a mere plaything, and yet, with a pressure of three and a half atmospheres, it has sufficient power to drive the velocipede at a speed of from fifteen to eighteen miles per hour. The fireplace which heats the boiler is an ingenious novelty, and consists of a small gasometer fed by wood spirit. The vapor of the alcohol issues through holes, and gives a flame endowed with great calorific power. The fire is lighted at will, and in a few minutes steam is up. A method is provided for regulating the escape of the alcohol vapor, and consequently the intensity of the heat. Externally the boiler is furnished with two tubes rolled in the form of a spiral, so that the steam which is produced circulates through these continuously, and is exposed directly to the fire before entering the motor. The steam being superheated, no water is carried over with it. With a speed of eighteen miles an hour, the cost of alcohol consumed is from forty to sixty cents (this calculation, of course, for France). This is certainly not very economical, but it is very pleasant to have a horse under control which eats only when he works.

THE ELECTRIC SUN.

At the recent Industrial Exhibition at the Champs Elysées Paris, M. Lontin exhibited an apparatus with which a very interesting experiment may be tried. This device, which the inventor calls the "electric sun," is composed of four carbons radiating from the same center, but not touching each other. Four currents are passed through these carbons in the following manner: The first current enters at A and issues out through the carbon B. The second leaves through this same carbon and enters through the carbon C. The third current enters through the carbon C, and leaves through the carbon D. The fourth enters through A, and

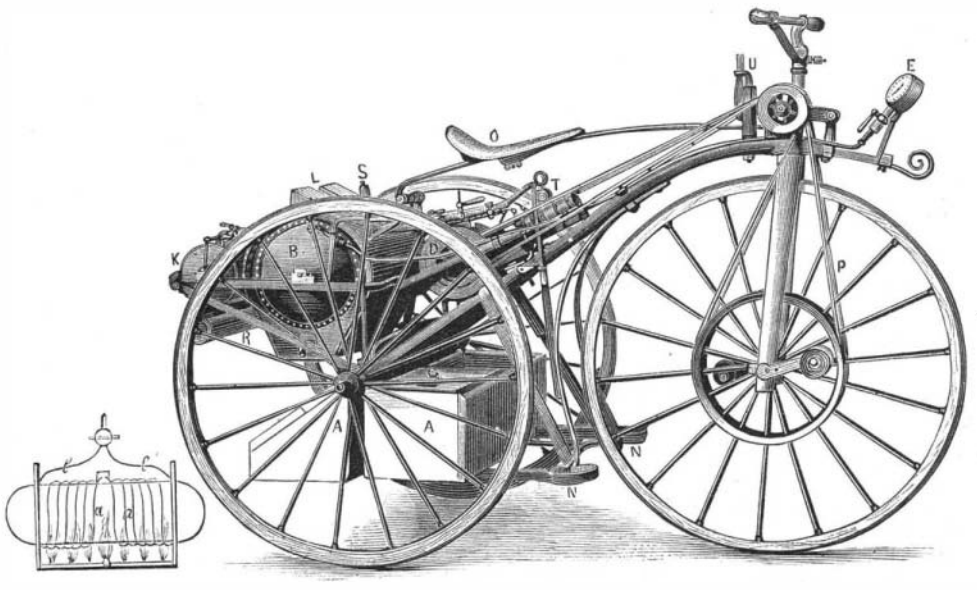


THE ELECTRIC SUN.

leaves through the carbon D, the result being a complete circle of light, which is due to the formation of four lateral voltaic arcs. The light obtained is exceedingly intense. This experiment proves that by this means foci of light of indefinite power may be obtained. When the carbons are further separated from each other flames are produced, not as they are under ordinary circumstances—with a diminution of light—but, on the contrary, with a considerable increase of it; and these flames sometimes attain a length of six inches, and quite often assume a forked shape. From whence comes this anomaly of a flame, augmenting the luminous intensity of the voltaic arc, and that too so strongly?

MISCELLANEOUS INVENTIONS

Mr. Harry L. St. Clair, of Winneconne, Wis., has patented an improved ironing table having pairs of legs which are hinged and jointed together in such manner as to adapt them to fold closely against the top.



STEAM VELOCIPEDE.

Edwin T. Greenfield, of New York city, has patented an improvement in automatic electric switches for telephones. The object of this invention is to provide for an automatic switch a movable electric or magnetic conductor that by its own gravity shall make or break magnetic and electric connection.

An improved attachment for vehicle wheels, to strengthen the felly joints, and at the same time keep the tires in place upon the wheels, has been patented by Mr. Charles Cremer, of Cosumne, Cal. It consists in the combination of a cap plate, formed to fit upon the rounded inner edge and the sides of the ends of the fellies, provided with pins to enter holes in the inner edges of the felly ends, and having its side arms projecting to overlap the side edges of the tire, and perforated with countersunk holes to receive a rivet.

Mr. Carl J. Swanson, of Stockwell, Ind., has patented a pump that can be used as a force pump or as an ordinary suction pump. The invention consists in a stopper composed of an inner ring of elastic material, an outer wooden ring, and two flat metallic rings.

Mr. George Binns, Jr., of Brooklyn (E. D.), N. Y., has patented a process and mechanism for forming pipes or tubes of pulp, for use as non-conducting coverings for steam pipes, generators, hot air pipes, water pipes, and gas pipes, and for use as conductor pipes for gas, steam, sewage, water, and other liquids.

Mr. Emil R. Völkel, of New York city, has patented a new method of taping furs which is simple and effective, and produces a strong and durable fur. It consists in fastening the strips of fur to some suitable backing by means of adhesive materials.

An improvement in slop jars has been patented by Mr Maurice Stransky, of New York city. The object of this invention is to furnish slop jars so constructed as to prevent spattering when liquids are poured into them, and to prevent odors from escaping into the room.

Mr. Emanuel J. Trum, of Brooklyn, N. Y., has patented an improved blotter which consists of a pad made of alternate sheets or layers of bibulous and non-bibulous paper, glued together at their ends in a manner to facilitate their ready separation.

An improvement in velocipede sleds has been patented by Mr. James H. Dennis, of Newark, N. J. The invention consists of a saddle, an open wheel standard carrying an end pivoted screw, a lever fulcrumed and connecting at one end with the screw and pivoted at the other end to a rod hooking on a crank shaft carrying spike wheels.

An improved game bat, patented by Mr. James O'Neil, of New York city, is composed of thin strips of wood bent double upon a form, and secured one upon the other by cement. The strips are spread at the bend to the required shape for the bat and united at their ends to form the handle. Between the layers of the strips forming the bow a strip of vulcanized or other fiber is interposed for imparting greater strength and elasticity.

An improvement in saddle-girth rings, patented by Messrs. Arnold Jehnke and John Swank, of Denver, Col., consists in constructing girth-rings with teeth or shoulders to prevent the strands of the rope or girth from being crowded together, and also in providing the girth-rings with pairs of stop rings to allow the middle part of the girth-rings to be left free from strands if desired.

Meteors.

News comes from Missouri that a man has been killed there by the downfall of a meteoric mass. It is described as about as large as a bucket, and resembling iron pyrites. It cut its way through the branches of a maple tree as clean as a cannon ball could have done, struck and killed the man, and then buried itself two feet in the ground. At first, many supposed the account to be a cleverly invented story of the great gooseberry type, but it has been confirmed, according to Mr. R. A. Proctor, in the Newcastle (England) *Weekly Chronicle*. The chance of a death occurring in any given year by meteoric downfall is small, but not so exceedingly small as many imagine. It could readily be calculated if we knew the average number of meteorites, large enough to break their way through the protecting armor of the air, which fall each year upon the earth. We may fairly assume that each human being (including all ages) presents an average surface toward the meteoric missiles of about one quarter of a square yard. (We must, of course, take into account the circumstance that meteors do not fall vertically; nor are all men all the time afoot.) Assuming the number of human beings in the world at each instant to be about 3,000,000,000, the space thus occupied by the human race as a whole would be one quarter of 3,000,000,000 of square yards. (It will presently be seen why I leave the result in this form.) Now the earth's surface contains 200,000,000 of square miles, each containing (nearly enough for such a calculation as this) 3,000,000 of square yards. Hence the surface of the earth contains 200,000 times 3,000,000,000 of square yards, whereas the human race covers but one quarter of 3,000,000,000 of square yards. So that the human race occupies but 1 800th part of the earth's surface. Therefore, if 2,000 meteorites annually reach the surface of the earth, the chances are but as 1 in 400 that one of these will kill a human being. On the average one human being would be killed in 400 years. It is worthy of notice, however, that if Professor Newton, of Yale College, is right in asserting that 400,000,000 of meteors of all orders, down to those visible only in a telescope, fall each year, the